the thymectomy cannot be made until more time has elapsed.

Edgeworth, herself a victim of myasthenia gravis, accidentally discovered that ephedrine afforded her some symptomatic relief. Ephedrine increases skeletal muscle power in myasthenia, but the mechanism of action is unknown. Its effectiveness is about 10 to 15% of that of prostigmine. Ephedrine is a useful adjunct to prostigmine therapy. Potassium chloride has a mild beneficial effect. There is some experimental evidence that potassium ions strongly sensitize ganglion cells to acetylcholine. Furthermore Brown and Feldberg suggest that the discharge of acetylcholine may be effected by potassium ions mobilized in the passage of the nerve impulse. In 1935, with these data in mind, Laurent and Walther reported that potassium chloride in large doses produced demonstrable improvement in myasthenia gravis. It produces disagreeable symptoms when taken by mouth in effective doses. At present, potassium chloride is also a useful adjunct to prostigmine therapy.

CONCLUSIONS

1. The manifestations of myasthenia gravis may be confined to the eyes and adnexa.

2. The muscles attached to the globe are resistant to prostigmine therapy. A dose greater than 1.5 mgm. of prostigmine may be required to produce a positive response for diagnostic purposes.

3. Myasthenia gravis should be included in the differential diagnosis of external ophthalmoplegia.

4. The exact relationship of the thymus to myasthenia gravis is unknown. However a patient with this disease may benefit from thymectomy.

We wish to thank Dr. R. C. Laird and Dr. J. C. McCulloch for their kind assistance in the preparation of this case report.

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AN ASSESSMENT OF THE RESULTS OF VAGOTOMY*

(Based upon personal experience of 66 cases.)

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IT is now about two years since we started doing vagotomies, and with an experience of 66 cases I feel it may be possible to pass judgment upon some of the results, even though sufficient time has not elapsed to permit anyone to guess what remote problems may yet develop.

Vagotomy abolishes the pain of ulcer, reduces the total volume of gastric secretion, brings about a state of achlorhydria and permits the inhibitor sympathetic nervous system to act unopposed upon the gastro-intestinal musculature, the augmentor having been severed.

The transabdominal route has met with almost universal acceptance as being more easily accomplished by the ordinary surgeon doing gastro-intestinal work. The original controversy as to the respective merits of transthoracic versus transabdominal routes has been settled in favour of the latter. There may be, however, isolated instances where an approach through the thorax may still be advantageous. Chest surgeons, loath to relinquish an operation of considerable simplicity, loudly proclaim its advantages, but the abdominal visual verification of the existence of disease, and the performance of other necessary surgical procedures weigh too heavily against it as an elective routine procedure.

For some time after Dragstedt's introduction of modern vagotomy, it was considered necessary to check the completeness of the operation by a gastric analysis done in hypoglycæmic states subsequent to the exhibition of insulin sufficient to cause the blood sugar level to fall below fifty. This proved frequently to be something of an ordeal, nevertheless, we faithfully carried this out on our first 23 cases. Twenty-two of these showed complete achlorhydria throughout the entire two-hour test period, the odd case showing a free acid of ten units on the fourth reading. We have in consequence abandoned this procedure, believing that vagotomy, thoroughly carried out, means complete subsequent achlorhydria of the neurogenic phase,

* Presented before the British Columbia Surgical Society, March, 1948.

and have reserved the insulin provocative test for doubtful or special occasions.

Of the 66 vagotomies, many results have been almost miraculous; many have been decidedly good, a few have given and still give concern, a few have been disastrous. Accustomed through the years to the smooth convalescence of gastrectomies I am at least able to say that these 66 vagotomies have given me more postoperative care and worries, have resulted in more work on the part of the postoperative staff than any other 66 of my most complex gastric resections. I believe that I have met with all the postoperative troubles that any other surgeon has encountered, gastric atony, bowel and gastric distension, nausea, hiccoughs, vomiting, diarrhœa and late obstruction.

Post-vagotomy diarrhœa has occurred in 23 of my cases. Its cause is unknown to me, but I believe that it must be of a neuro-muscular origin or possibly due to some as yet unrevealed change in pancreas, liver, or enteric secretions. It does not occur following gastric resection so

TABLE I.
VAGOTOMIES

	Cases
Duodenal ulcer	39
Gastric ulcer	13
Marginal ulcer	11
Differential section	3
	66

TABLE II.
POST-VAGOTOMY DIARRHŒA

Number of cases	23/66	34.8%
Duration:		
Less than a month	18/23	78.0%
More than three months	3/23	13.0%
Over a year	1/23	4.3%
Severe diarrhœa	5/23	21.7%

can hardly be of an infective nature due to elimination of the acid-sterilizing influence from the stomach. In two of my cases severe hypoproteinæmic states developed coincident with the diarrhœa, and proved to be well nigh irreversible. Large quantities of plasma, intravenous and oral amino-acids, had to be given over several weeks, but recovery occurred with dramatic suddenness in both instances, as though a back log of tissue hypoproteinæmia had finally been overcome. Diarrhœa in one of these two cases subsided with the return of normal protein levels, the other more slowly. None of the remedies in common advocacy for post-vagotomy diarrhœa has had the slightest therapeutic effect. Urocholine proved valueless. Cessation occurs as a result of some as yet uncharted restoration of neurocirculatory balance.

Two of my cases who had had severe diarrhœa developed late obstruction, five months and seven months respectively, one of these had had multiple previous laparotomies and might be excused, but the other was a primary operation. There would appear to be developing in the literature an increasing incidence of late obstructions—the sequence being epigastric fullness, distension, diarrhœa and obstruction.

TABLE III.
HYPOPROTEINÆMIA AS A RESULT OF POST-VAGOTOMY DIARRHŒA

1947	*Plasma protein percentage*	*Cell volume percentage*
January 13	5.95	47.0
January 28 (Operation)	5.31	41.0
February 1	4.00	36.0
February 3	4.22	37.0
February 6	4.00	35.0
February 7	3.97	34.0
February 22	4.00	34.0
February 27	6.01	37.0
1948		
February 8	4.25	38.0
February 12	4.22	38.0
February 17	5.96	44.0

VAGOTOMY FOR DUODENAL ULCER

Why has vagotomy received such acclaim, particularly with respect to intractable duodenal ulcer, the surgical treatment of which had in recent years become so standardized and whose curability percentage had run around 90%? The answer is that the 10% who have not had such a desirable result following modern gastric resection or earlier gastroenterostomy were in worse shape than prior to their operation. The world has been looking for something which would bring a large measure of relief to these 10% of unfortunates.

The mobile, non-penetrating duodenal ulcer which has not bled has for long years been established as a medical, not a surgical problem, and represents 90% of the duodenal ulcers. But the penetrating ulcer with points of fixation to pancreas, bile ducts or adjacent viscera, with continued pain, resulting from hyperacidity, which has in the past been defined as an "intractable" ulcer, must be regarded as a 100% surgical problem. Around this ulcer for years has raged the controversy of ulcer resection, or resection by exclusion as advocated by Devine and Finisterer. There can be no doubt but that exclusion resection in which a pouch of antral mucosa is allowed to remain, has been proved to be a potent

source of marginal ulceration. It is equally certain that the need for exclusion resection decreases in proportion to the experience and ability of the surgeon. Most duodenal ulcers, while heavily indurated, are actually not large and can in the vast majority of instances be removed with sufficient duodenum distal to them to permit closure. If they are so far down that this is not possible then there is in the vast majority of instances sufficient duodenum above them to permit resection with complete excision of all antral mucosa. An ulcer, however, may be irresectable on the grounds of inadvisability rather than physical impossibility.

I have performed transabdominal vagotomy in 39 cases of intractable duodenal ulcer as recorded in Table IV.

TABLE IV.
DUODENAL ULCER

With gastro-enterostomy	33
With exclusion on resection	3
Gastric resection and differential section	3
	39

Posterior gastro-enterostomy was done in 33 of these cases as a supplement to vagotomy, because in nearly all instances there was some degree of duodenal obstruction, either from scar, induration, or œdema. I have been very dissatisfied with the procedure. Gastro-enterostomy does nothing to prevent gastric distension, and until a large measure of tone is restored to the stomach it does little in the way of effecting drainage. Consider that the results of gastro-enterostomy alone in the treatment of duodenal ulcer, gave a fairly high percentage of cures; in these instances it tends to becloud the issue and to make it difficult to assess whether the results are due to vagotomy or gastro-enterostomy. Three cases where an exclusion resection, removing 75% of the stomach to the pylorus, were fortified by complete vagotomy and in three cases with extremely high acid values, 75% of the stomach, including the duodenal ulcer, were resected and were fortified by resection of the anterior vagus. It is in these extremely high acid values that subsequent marginal ulceration is prone to develop, and the differential section was performed in an attempt to discourage such a sequel, even after adequate resection.

The result of gastric resection for intractable duodenal ulcer, with excision of the ulcer and removal of at least 75% of the stomach, has given such dramatic and excellent results through the years, with a mortality rate of under 3%, and a morbidity rate far below vagotomy, that I have now practically abandoned the use of vagotomy for duodenal ulcer and have gone back to resection. Gastric resection is still with me the yardstick by which all other operations for ulcer must be measured. I believe, however, that the advantages of selected vagotomy far outweigh its disadvantages and after six months practically all my cases are in excellent health. But so are my resections and they do not require this six months' period of gastro-intestinal rehabilitation. Furthermore, vagotomy is quite as irreversible a procedure as is gastric resection and in my hands has carried a higher mortality.

My opinion in connection with vagotomy for duodenal ulcer is that it should be reserved for those cases in which resection is inadvisable, technically too difficult, or as a fortification to resection in cases of excessively high acid values. All other surgical intractable duodenal ulcers should have a gastric resection of a standard consistent with modern concepts of adequacy.

TABLE V.
COMPARATIVE MORTALITY

	Operative deaths	*Percentage*
480 Gastric resections for ulcer (successive)	13	2.2
66 Vagotomies (successive)	3	4.5

TABLE VI.
CAUSE OF DEATH

Intestinal obstruction	1
Pneumonia	1
Subphrenic abscess and obstruction	1

SECONDARY MARGINAL ULCERATION

It is in these cases of marginal ulceration following gastric resection or gastro-enterostomy for duodenal ulcer that vagotomy weaves its most potent magic. These cases are the real reason why something like vagotomy became necessary and was so welcome, while a few of these cases were cured by more complete subsequent resections or removal of remaining antral pouches left in previous exclusion resections, the great majority remained crippled, unrelieved and usually in greater distress as a result of it, than they were with the condition which their operation had been designed to relieve.

I have now operated upon 11 of these cases with the most dramatically successful results in 10 of them; the odd case died of intestinal

obstruction following gross distension from postoperative intestinal atony. In every instance pain was abolished at once, all have become acid-free and all have remained perfectly well. While I am convinced that such uniformly gratifying results could not be maintained over a much larger series, yet if vagotomy does no more than restore a high percentage of these cases of secondary gastro-jejunal ulcerations, that alone will place it high on the list of justifiable and worthwhile surgical procedures of exceptional merit.

TABLE VII.

MARGINAL ULCERATIONS

Successful results	10
Unsuccessful results, intestinal obstruction 22nd day	1
	11

HIGH GASTRIC ULCER

Probably no single phase of gastric surgery carries a heavier load of responsibility than the decision as to what to do with these cases. Faced with the prospect of its potential malignancy, there are no criteria by which this can positively be determined short of pathological investigation of the resected specimen, yet the vast majority of them are not malignant and I do not know of any non-malignant gastric lesion which would justify total gastric resection. Transthoracic resection of the top half of the stomach and anastomosis to the œsophagus in the thorax may be the real answer but it is an extensive procedure outside the ambit of the average surgeon and not to be lightly undertaken.

There is no sure way in which the nature of these ulcers can be accurately determined, but through the years my observation has been that a high acid is apt to be associated with benignity, low acids or achlorhydria strongly suggest potential malignancy. Taken in conjunction with the other available clinical, hæmatological, radiological and gastroscopic evidence, the percentage of error can be reduced fairly low. In consequence of my reluctance to do a total gastrectomy for high perforating posterior gastric or gastro-œsophageal ulcers associated with a high acid, I have in 13 of these cases performed a simple bilateral vagotomy. In every instance the ulcer has healed promptly, pain has been relieved, the crater could no longer be visualized, and achlorhydria developed. For as long as 17 months these cases have been rechecked. One case required subsequent gastroenterostomy to overcome a paretic stomach, this was not done on the other twelve cases as the pylorus was normal and the duodenum unobstructed.

This I believe to be one of vagotomy's main contributions to gastric surgery. All of these cases are cured, with preservation of their stomachs which to my mind is preferable to total gastrectomy with its attendant postoperative semi-invalidism. The argument may well arise that these ulcers may be malignant, but even if they are, the ones that are will not heal and gastroscopic and radiological evidence will soon pick these up four weeks postoperatively. If these high posterior perforating ulcers are malignant then they are no longer merely malignant ulcers of the stomach but malignant ulcers with invasion of surrounding viscera, and even six weeks earlier resection of this type of case would make no material difference in the ultimate result; they are bad enough in any event.

High gastric ulcer having criteria suggestive of benignity should be given a chance with simple, bilateral vagotomy—should be carefully rechecked four weeks later—those in whom healing has not taken place should be resected. The incidence of malignancy in the scar of a healed gastric ulcer is of negligible importance. A great many stomachs can be saved in this way without unduly compromising our position with respect to malignancy.

How permanent may we consider the effects of vagotomy to be? We have rechecked 9 of our early cases of a year or more duration by fractional gastric analysis, and 6 have no free hydrochloric after two hours' investigation. Three who had had postoperative achlorhydria have free acid values, the highest reading being thirteen. Should we regard this return of low acid values with anxiety? I think not. Acid is not the cause of ulcer, and physiologically a level of acid values within what we have come to define as normal limits surely must be an advantageous condition. It is not the normal acid values that we fear but rather hyperchlorhydria and I should feel very discouraged indeed if any of my cases were to return with high acid values; however, none have. There would appear to be ample time between vagotomy and the beginning restitution of acid to permit ulcers

to heal soundly—all those at least which are going to heal.

Month by month my vagotomy cases improve. The primary or neurogenic phase of secretion is abolished and with it the symptoms, but there is nothing to substantiate the belief that the secretory function of the hormonal phase of secretion is grossly disturbed. Once these post-vagotomy cases become stabilized they seem to be perfectly comfortable, they may have more "gas" than the gastrectomies, but there is a long period when they are in minor distress from one or other cause.

This time vagotomy is here to stay. Earlier in the century, attempts were made to divide the nerves to the ulcer. Now we are dividing vagi to the stomach which contains the ulcer, confident that the ulcer itself is probably just the local manifestation of a more general and ill-understood phenomenon. More and more we are treating patients who have peptic ulcer, less and less we are treating ulcer itself. The importance of hypoproteinæmic states on the maintenance of ulcer diathesis is becoming more clearly understood. The ramifications of vagotomy are wide and reports are filtering through of highly satisfactory results following its use in ulcerative colitis and kindred disorders. It has stimulated a tremendous interest in the physiology and chemistry of gastric secretion, it has already resulted in serious questionings as to the adequacy of our methods of testing and measuring gastric secretion in our clinical laboratories. It has brought us additional proof that all peptic ulcers do not heal with the development of anacidity. The old battle cry "No acid, no peptic ulcer" may still be true with respect to the genesis of ulcer, but is definitely not true with respect to its perpetuation. They can and do remain unhealed in the achlorhydric stomach.

It took me ten years to assess the value of gastro-enterostomy. It took another ten to properly evaluate gastric resection and it will probably require ten to clearly establish the position of vagotomy. From my own personal experience I believe that its greatest value is in the eradication of stubborn pockets of difficulty as in marginal ulceration and high perforating gastric ulcer. Its advantages in these situations, in my opinion, far outweigh its disadvantages.

CASE REPORTS

ACUTE PERICARDITIS SIMULATING ACUTE CORONARY OCCLUSION

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I would like to report a recent case of acute pericarditis simulating acute coronary occlusion because of its rarity and also because of the interest it aroused among our members. I was only able to find one reference to this condition. Drs. Barnes and Burchell of Mayo's Clinic[1] reported 14 cases in which 9 were definitely diagnosed as acute pericarditis.

These authorities state that there is a distinctive form of pericarditis of a benign non-suppurative nature. Pain in the chest is the most outstanding complaint. There are patients regarding whom the crucial question arises whether the diagnosis should be acute coronary occlusion or acute pericarditis. The problem is complicated still further by the well known fact that patients who have acute coronary occlusion may have pericarditis as an adjunct. The importance of making the correct diagnosis is obvious.

In some of these cases at no time are there any x-ray changes. This was found in the patient herewith reported. The correct diagnosis is made by means of the electrocardiograph. There will be upward displacement in one or a combination of the standard leads. The RT segment is either concave upward or forms a straight line from its origin in the R wave to the crest of the T wave. This is to be contrasted with the upward convexity of the elevated RT segment in coronary occlusion. Reciprocal deviations of RS—T segments on Lead 1 and 3, such as may occur after acute coronary occlusion, rarely occur in uncomplicated pericarditis. The T waves in acute pericarditis primarily tend to undergo one of two changes; they may become exaggerated in amplitude or sharply peaked as in our case, or they may be rounded with a dome shape. There is no Q or T pattern.

Within one to six weeks after the acute phase of pericarditis subsides, the electrocardiogram returns to normal or begins to approach normal limits. In the case here reported a normal

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